L2 Knowledge of Target Phonotactics: Learner Judgments of French Re-suffixation

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1. Introduction

In Second Language Acquisition, the question of whether L2 (second language) grammars are constrained by the same principles as native L1 (first language) grammars has often been asked (e.g., White, 2004). A substantial body of work in L2 syntax has demonstrated that learners judge new material—material that is underdetermined with respect to L2 input—like their native counterparts (Anderson, 2002; Dekydspotter, Sprouse, & Anderson 1997; Flynn, 1987; Martohardjono, 1993; Oh, 2007; White, Valenzuela, Kozlowska-MacGregor, & Leung, 2004). For example, Oh (2007) investigated form-to-meaning mappings in the L2 acquisition of English Double Object (DO) constructions by native speakers of Korean. The experimental design exploited semantic properties of verb categories that are either shared or different between English and Korean. Her grammaticality judgment task was constructed based on the observation that goal-oriented direct objects are structurally comparable in both languages whereas benefactive direct objects are structurally different. Subjects were presented in writing with a series of randomized sentences, each preceded by a small written context, and then asked to rate the grammaticality on a 4-point scale.

(1) Grammaticality judgment task with benefactive direct objects in English (Oh, 2007, p. 295)
    a. *John/the movie gave an idea to Mary.
    b. John/the movie gave Mary an idea.
    c. *John gave a kick/a kiss/a hug to Mary.
    d. John gave Mary a kick/a kiss/a hug.

   How acceptable does the sentence sound?
   1 – completely unacceptable
   2 – somewhat unacceptable
   3 – somewhat acceptable.
   4 – completely acceptable
   5 – not sure

L1 Korean subjects were able to correctly identify the ungrammaticality of items such as 1c, demonstrating a consistent capability of overcoming negative transfer effects even at an intermediate level of proficiency. Oh concluded that (a) L1-transfer is operative in L2-acquisition at the level of syntax and (b) L2-learners have access to UG-based syntactic and semantic distinctions, which allow them to overcome the poverty of the stimulus problem. The findings of such research support strong-UG hypotheses in second language acquisition, that is, the claim that such implicit knowledge of these properties could only have arisen from a specific mental architecture for language.

While previous studies have demonstrated native-like L2 judgments of syntactic well-formedness and interpretation, it is not known whether learners demonstrate similar abilities in L2 phonology. Our understanding of the L2 phonological system has been limited by an almost exclusive focus on learner production, following the observation that L2 pronunciation is virtually never target-like (Long, 1990;

Spadaro, 1998). It has been demonstrated that the typical final state of L2 phonology is at best an approximation of its native (L1) counterpart and contains persistent errors among otherwise advanced students, who, in many cases, began learning under age 12 (e.g., Flege, Munro, & MacKay, 1995). A learner may live the majority of his or her life in the target culture, achieve near-target-like morphology and syntax, and yet perpetually retain a foreign accent. The overwhelming evidence of learner limitations has led researchers and language teachers to the same less than optimistic conclusion: an L2 phonological system generally cannot be fully acquired in adulthood. This in turn has consequences for the ongoing debate about the accessibility of UG in L2 grammars: given the poor prognosis of L2 phonological production, even if it can be shown that UG constrains L2 syntax, there is no *a priori* evidence that this is also the case for L2 phonology.

Yet, there is little question that the sum of an individual's grammatical knowledge is more than the all of his utterances to date or his overall speech performance. In reference to both native L1 acquisition and to adult L2 acquisition, it is widely accepted that speaker knowledge exceeds linguistic output. Observations of speech production alone cannot provide a complete picture of the L2 grammatical system; studies that incorporate learner judgment and intuitions are sorely needed. Such investigations would have direct consequences for the question of UG access/non-access in L2 systems. The present study represents an initial attempt at probing L2 phonotactic intuitions in parallel fashion to existing psycholinguistic studies that have tested novel L2 syntactic structure.

For the purposes of this study, the term *phonotactics* refers to restrictions that languages place on the phonological shape of words. It has been shown that, when asked to evaluate the well-formedness of new items, native speakers have strong intuitions about structures that they have never before uttered nor heard (Greenberg & Jenkins, 1964; Scholes, 1966). English speakers, for instance, are much more likely to believe that a nonword that respects English phonotactic rules, such as *brenk*, could be a possible word, while a phonotactically illicit nonword, such as *tloitch*, could not be. This is known as *wordlikeness*, the degree to which a nonword sounds like a possible word to speakers of a language. But in addition to formal phonological constraints, wordlikeness has also been shown to be influenced by frequency effects in the lexicon (Bailey & Hahn, 2001; Coleman & Pierrehumbert, 1997). In a phenomenon known as the *neighborhood effect*, speakers judge nonwords more favorably when they resemble real words in the language, and if those real words occur more frequently (Greenberg & Jenkins, 1964; Storkel & Rogers, 2000). This means that the usefulness of nonword stimuli in the testing of intuitions regarding formal phonological constraints is questionable, and likely to be confounded by lexical neighborhood factors.

However, there are various ways in which phonotactic effects surface as a clear result of formal phonological grammar, such as in the famous *wug* test (Berko, 1958, cited in Hale & Rice, 2008), and in the adaptation of foreign loanwords (e.g., Paradis & Prunet, 2000). In addition, native speakers agree on the phonological acceptability of word transformations and morphological derivations. For example, imagine that a native speaker of English were presented with unfamiliar first-names, such as in (2), attested in Botne and Davis (2000) and Van Dam (2003):

(2) a. Sigmund
    b. Sholtenberg

If asked to assign a hypocoristic ("nickname") to these newly-encountered names, a native English speaker will almost certainly provide the following:

(3) a. Siggy (or Ziggy)
    b. Sholty (or different spelling to represent the same pronunciation)

Crucially, the native speaker will not prefer forms such as *Sigmy for (a) or *Sholly for (b). The morphological root that is identified for (a) is [zig-], and not *[zigm-], in spite of the fact that such word-internal consonant sequences occur elsewhere in the language (i.e., "pygmy"). Other names belonging to the same category as Sigmund are Mildred (*Milly* not *Mildry*) or Douglas (*Dougie* not *Douglie*). On the other hand, plenty of other names (and countless words) pattern like the type in (b), such as Charles (*Charlie* not *Charry*) and Jordan (*Jordy* not *Jory*). Hypocoristics constitute an

example of a learning paradox in language acquisition, given that systematicity is achieved despite variable and/or apparently opaque evidence in the speaker input. Any probabilistic account of these items encounters great difficulty, given that words analogous to the syllable structures of *Douglie* and *Jory* enjoy an extremely high frequency in the language. A theory of phonological grammar fares far better, because it includes information such as the optimal shape of derived root words in alternations. In the case of English, it specifies that a derived root ending in falling sonority is well-formed (jord-), but one ending in rising sonority ill-formed (*zigm-), which is why the hypocoristics of type (b) conserve both original consonants at the morpheme boundary while those of type (a) do not.

The present study seeks to determine whether adult L2 learners possess native-like intuitions of word transformations in the target language, which would implicate the acquisition of phonotactic constraints operative at abstract levels in the L2 phonology. To my knowledge, there exist no previous studies in passive metalinguistic assessment (judgment) of L2 word items. The methodology employed resembles that of psycholinguistic studies in L2 syntax, in that it is designed to probe adult learner knowledge of L2 phonotactics in the absence of either sufficient data in the input or explicit teaching, and in spite of L1 transfer.

2. Learnability distinctions in French and English
2.1. Maximal clusters in coda position

For native speakers of English, learning French syllable structure is both easy and difficult. It is easy because the types of syllables observed in the surface forms of French words also occur in English words. But it is difficult because English allows for a greater range of consonant clusters in coda position than French. In order to acquire the correct underlying structure, the L1 English learner must restrict the hypothesis space of allowable syllable types, in essence, shrinking the L1 specifications. This provides a classic learnability problem, since no evidence from French phonotactic distribution can inform the learner of the fact that the full range of English clusters is not possible. To complicate matters, the French data available to the learner is misleading because numerous *apparent* exceptions to cluster limitations in French do exist. Thus, on the surface, there is nothing to suggest that French syllable structure is not, in fact, just like English syllable structure.

The primary focus of this study exploits a parametric difference between French and English regarding the maximum number of consonants that occur in syllable codas. The facts of English and French syllable structure can be accounted for through a variety of representational frameworks (e.g., timing tiers, formal constituents such as onset, nucleus, coda, and rime). I adopt a moraic model (Hayes, 1989) in which onset consonants are linked directly to the syllable node and nuclei and coda consonants are linked directly with moras. The English syllable is more complex than the French syllable in that it allows codas with three or more consonants (Goldsmith, 1990; Hall, 2001). By contrast, French is commonly assumed to contain a maximum of one coda consonant (Dell, 1995; Plénat, 1987; Rialland, 1995). At first glance, it may appear that French and English syllable allowances are similar, given that both languages have well-formed CVCC words, such as the cognates in (4a). There are also numerous examples of verbally derived CC clusters word-finally in French, as shown in (4b).

(4) Examples of French and English words containing CC clusters
     a.   English-French cognate words ending in a CC cluster
          strict / stricte   [stʁikt]
          concept / concept   [kɔ̃sɛpt]
          film / film   [film]
          park / parc   [paʁk]

b. Derived / inflectional CC words in French

sortent	[sɔʁt]	'(they) go out'
perdent	[pɛʁd]	'(they) lose'
vivre	[vivʁ]	'to live'
respecte	[ʁɛspɛkt]	'(s/he) respects'

In addition, apparent examples of CCC emerge in French as the result of post-lexical schwa-deletion, such as in the surface forms in (5). In the normal speech that most learners of French would be exposed to, these items would contain a CCC sequence.

(5) Derived examples of CCC in French
    a. *parl(e)rai*   [paʁlʁe]   '(I) will speak'
    b. *capt(e)rai*   [kaptʁe]   '(I) will take'

There are also underived words in French that contain super-heavy (CCC) syllables, such as in the examples in (6).

(6) French words containing a CCC cluster
    a. *ordre*   [ɔʁdʁ]   'order'
    b. *marbre*   [maʁbʁ]   'marble'
    c. *fichtre*   [fiʃtʁ]   'gosh'
    d. *Marx*   [maʁks]   'marx'

However, there are at least two facts which reveal the underlying cluster limits in French and English. First, the French examples in (5a-b) are phonetic consequences of schwa deletion that commonly occur in the pronunciation of irreal (conditional and future) tenses. It is limited to a particular verb paradigm, which only ever contains an [ʁ]-initial ([-ʁV]) suffix. In slow speech, it is normal to pronounce the schwa and break the CCC cluster in items such as these, which further demonstrates that this is not part of the underlying structure.

    Second, in contrast to French, English allows consonant clusters word-finally and word-medially in a generalized and productive way. The examples in (7) illustrate that in English, many inflectional and derivational suffixes are consonants or consonant-initial and yield a CCC sequence. The examples in (7) illustrate the occurrence of CCC sequences word-internally in English.

(7) Examples of suffixes that create a CCC sequence in English

a.	part	→	partly	[partli]
b.	find	→	finds	[findz]
c.	belch	→	belched	[bɛltʃt]
d.	estrange	→	estrangement	[ɛstrenžmɛnt]
e.	help	→	helpful	[hɛlpful]
f.	shield	→	shields	[ʃildz]
g.	fault	→	faultless	[fɔltlɛs]
h.	irk	→	irksome	[ərksəm]

(8) Examples of word-internal (non-productive) CCC sequences in English

a.	gauntlet	[gɔntlɛt]
b.	partner	[partnər]
c.	Salisbury	[salzbəri]
d.	constraint	[kənstreⁱnt]
e.	ingrate	[ɪngreⁱt]
f.	empty	[ɛmpti]
g.	antler	[æntlər]
h.	sculpture	[skʌlptʃər]

While English suffixation regularly generates a CVCC syllable, suffixation in French respects a CVC syllable restriction. In the cognates below (which include suffixed and similar mono-morphemic forms), the presence of schwa may be seen as one way in which French repairs a possible CCC occurrence.

(9) French / English cognates displaying consonant cluster alternations

	French		English	
a.	*appartement*	[a.paʁ.tə.mã]	apartment	[ə.part.mənt]
b.	*calmement*	[kal.mə.mã]	calmly	[kalm.li]
c.	*embarquement*	[ã.baʁ.kə.mã]	embarkment	[ɛm.bark.mənt]
d.	*partenaire*	[paʁ.tə.nɛʁ]	partner	[part.nər]

Several phonologists working on French (cf. Dell, 1995; Plénat, 1987; Steele, 2002) have claimed that words ending in more than one consonant are the result of extra-syllabic positioning of the additional consonant. Although working in different frameworks, various researchers have arrived at a similar conclusion. Rather than being a member of the coda, mora, or X-unit that is occupied by the preceding vowel, extra consonants in French are argued to lie outside of that structure. Some phonologists (Dell, 1995; Scullen, 1997; Steele, 2002) have specifically claimed that the extra consonant forms an onset to an empty syllable (the onset-to-an-empty-syllable hypothesis, or OESH). Given that French exhibits extra-syllabicity elsewhere in the language (liaison, elision, mute-e phenomena), the position is not surprising, and agrees with the claim that French is, at most, a CVC language.

By contrast, English has been analyzed as counting among those (few) languages that can produce a trimoraic syllable[1] (Hall, 2001; Hammond, 1999). In simple terms, the English syllable appears to allow an additional coda consonant compared to the French syllable. As shown in (8), the number of productive suffixes that regularly create CCC words supports the claim that English allows a superheavy structure. Given the empirical evidence, I adopt the separate structures in (10) for French and English. The cognate *park*, shared by both languages, illustrates the position of consonants in their underlying structures. The dotted line in (10b) indicates that while the final consonant is lexically and phonetically realized as part of the word *park*, it functions as an onset, rather than a coda, in the phonological structure.

(10) Structure of the word *park* in English and French
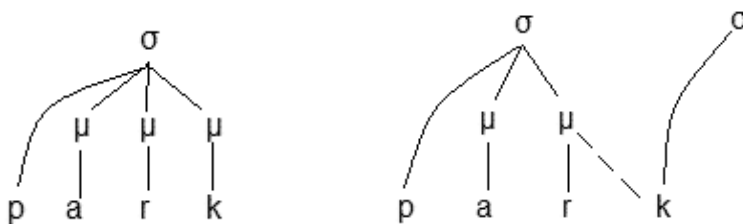
(a) English   (b) French

The treatment of English is similar to that of Hall (2001) and Spencer (1996) in that I assume that all consonants are fully syllabified (i.e., lie structurally within the syllable). Like Hall's analysis, this structure also does not allow for a branching mora. English syllables can presumably also accommodate an appendix, following three moras, such as in the word *parks*. This third coda consonant would be licensed directly by the syllable. Thus my claim up to this point is that the English

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[1] Other languages that have been claimed to contain super-heavy (tri-moraic) consonants include Dutch, Finnish and German (Hall 2001). As tri-moraic consonants are controversial largely because of the desire to respect structural binarity, Hall states that any moraic treatment that assumes universality must make provisions for super-heavy syllables.

syllable licenses a maximum of three moras, while the French syllable licenses a maximum of two. I have adapted the OESH within Moraic Theory, and assume that in French, a second or third coda consonant is licensed as the onset to an empty syllable. As stated above, given the other common forms of re-syllabification (elision, liaison) in French, a version of the OESH, such as in the structure in (10b), is an intuitive representation.

In terms of learnability, while French is best analyzed as a CVC language, more complex forms do surface. The French examples above constitute evidence in the learner input to suggest that French *does* licence an extra-heavy coda. At the very least, the "exceptions" to CVC structure are numerous enough to justify a claim that the French input is degenerate and varied. In terms of a "logical" problem of acquisition, French is a subset grammar with respect to English. Given that patterns of consonant cluster limits are not explicitly taught, there is no concrete evidence that would disabuse English learners of the belief that CCC sequences are allowed in the French lexicon, and that French and English syllables have the same underlying structure and maximal constraints.

2.2. Lexical frequency inquiries

In order to further understand the nature of French input and a possible correlation between phonotactic intuitions and lexical frequencies, a search was conducted using the Lexique database (New, Pallier, Ferrand, & Matos, 2001). While no word database is perfect, Lexique has a number of advantages. First, it compares search results from both spoken and literary databanks. Secondly, it allows for simultaneous or combined searches of different items. For example, it is possible to search for two spellings of a sound sequence (i.e., –rk- and –rque-) at the same time. The frequency numbers provided represent the number of occurrences of the word per 10,000 words encountered in the database. While it is difficult to define a "rare" versus "common" word in strict numeric terms, I follow the convention stated by New et al. that a word with a frequency rating of less than 5 is sufficiently rare that most advanced learners of French have not encountered it. Table 1 provides information from a lexical search of the suffix –*ingue* as well as searches for word-internal [rl] and [rk] sequences in French. In the case of the –*ingue* report, unsuffixed words that simply end in –*ingue* (i.e., *dingue*, 'crazy'; or *bilingue*, 'bilingual') are not included. While one can count 24 true re-suffixed –*ingue* words from the count, they were all extremely rare, as shown below. Results from the [rl] and [rk] searches show that there are more total words containing word-internal [rl] than [rk]. However, there are more word-internal [rk] words occurring more frequently (121 versus 80). In terms of language input, it is safe to say that [rl] and [rk] should have more or less equal status in terms of exposure and acceptability.

Table 1. *Frequency Report on Items from the Lexique Spoken Language Database*

	-ingue suffix	[-rl-]	[-rk-] (-rk- and -rqu- spellings)
total # words	24	519	396
# of words occurring more than 5 times / 10,000	0	80	121
rate of most frequently occurring word	.12 (*cradingue* 'dirty', 'vulgar')	1970.58 (*parle* 'speak')	1348.04 (*pourquoi* 'why')

At this time, it is not possible to conduct a search of frequencies of unspecified CCC sequences, which means that any attempt to determine the frequency of CCC words involves extensive manipulation. It is also not possible to take into account cases of phonetic CCC emergence (i.e., parl(e)rai) in the search. Because it is necessary to enter orthographic representations of words or sound sequences, one must create a complete list of all spellings of all CCC permutations in order to attempt such a search.

Using the Petit Robert dictionary and the list of French clusters from Dell (1995), I have constructed a reasonably accurate list of spelled CCC clusters in French. The numerous words in French that are spelled with final consonants that are never pronounced (e.g., the orthographic *d* and *s*

in the word *foulards* [fulaʁ], 'scarves') must then be extracted from the report. While I believe that the final product gives an idea of the number and frequency of CCC words in spoken French input, it comes with the important disclaimer that the report is an incomplete, rough estimate. It does support the previous claims that CCC sequences occur in French, but that the words are relatively rare. Of the 1,700 CCC words in the report, over 1,400 contained s-clusters, and very few of these (i.e., 14) had a frequency greater than 5 per 10,000. Of the remaining 300 words, more than half (158) occurred less than 5 times per 10,000 words. The two most frequently occurring words among the non-s-cluster items were *perdre* ('to lose'; 546 per 10,000) and *meurtre* ('murder'; 104.5 per 10,000).

2.3. Popular French re-suffixation

In order to compare learner and native speaker judgments of consonant cluster limits in French, a stimulus was constructed based on an existing word transformation termed "Popular French re-suffixation" (Plénat, 1999). In this type of language game, the transformed words permit the observation of repair strategies for underlying CCC sequences in French because: (a) the root that is produced ends in one or two consonants, and (b) the suffix that attaches to the root begins with an initial consonant that *deletes* after a stem ending in two consonants. The data in (11) represent a sample of the data from Plénat (1999), and illustrate the patterning of the allomorphs (*-ingue*, *-lingue*, *-dingue* and *-zingue*) in this transformation.

(11) Examples of –ingue allomorphs

	Original Word	*Root*	*Suffixed Form*	*Gloss*
a.	lufaʁ[2]	luf-	lufdɛ̃g	'crazy'
b.	mɔʃ	mɔʃ-	mɔʃdɛ̃g	'ugly'
c.	plymaʁ	plym-	plymzɛ̃g	'pen'
d.	gɔg	gɔg-	gɔgzɛ̃g	'latrine'
e.	tiʁwaʁ	tiʁ-	tiʁlɛ̃g	'drawer'
f.	byʁo	byʁ-	byʁlɛ̃g	'office'
g.	lazã	laz-	lazɛ̃g (*lazdɛ̃g)	'billfold'
h.	ɛskaʁgo	ɛskaʁg-	ɛskaʁgɛ̃g (*ɛskaʁɛ̃g)	'snail'
i.	tʁavlo	tʁavl-	tʁavlɛ̃g	'transvestite'

Re-suffixation allomorphy also reveals the emergence of universally unmarked forms in this paradigm. Interestingly, the examples (11b) and (11c) also show a conspiracy toward continuancy dissimilation in the re-suffixed word. Forms such as *[mɔʃzɛ̃g] or *[gɔgdɛ̃g] cannot emerge, perhaps due to a constraint against OCP continuancy effects in the derived context. Additionally, items (11e) and (11f) show the preference for sonorancy assimilation across the morpheme boundary. In this case, the identity of the suffix consonant is less important than sharing the feature [α-son] among the members of the cluster.

3. Word judgment experiment

Following the rules of Popular French re-suffixation, novel word items were created for the stimulus of this judgment task. Since the goal is to observe native and learner knowledge that could not arise from memorization, analogy, or explicit teaching, *-ingue* re-suffixation presents a number of advantages. First, most learners have never heard of re-suffixation and have probably never been exposed to re-suffixed words. This helps to ensure that subjects are responding to the items based on intuition, rather than analogy or knowledge about French. Second, such items have no direct correlate in the L1, thus minimizing or eliminating the variable of L1 calquing when measuring learner

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[2] It is worth noting that items (a), (c) and (i) are themselves slang words which are derived from original, non-slang words. This has no consequence for the phonological analysis, however, since the root that is formed from these items is the same as the root that is derived from the original French word.

judgments. Finally, the transformed items have lexical status (as opposed to pure nonce words) and carry the same category and meaning of the original word. This means that a possible confound due to neighborhood factors is effectively sidestepped.

3.1. Methodological Design

This study specifically investigates L2 knowledge of two structural features. The primary focus examines the maximal syllable that learners will allow as a result of the suffixation, hereafter referred to as the CC test. The task presents subjects with both CC items (i.e., [palmɛ̃g]) and CCC counterpart items (i.e., [palmzɛ̃g]), and asks for an acceptability rating. A hypothesis for this part of the task is given in (12). Native-like adult L2 performance on such a task should implicate access to UG for three reasons. First, the difference between French and English regarding consonant clusters allowed in syllable codas is such that L1 transfer cannot be a source of knowledge about target language parameters. Second, rules concerning cluster limits and derived environment constraints are not taught in the French classroom, which indicates a learning paradox, if not a classic case of poverty of the stimulus. Third, the evidence in the target language input is degenerate and misleading, meaning that superficially, it appears that French grammar allows the same super-heavy syllable structures that occur in English. In addition, the task was designed to probe learner and native acceptability judgments concerning sonorancy assimilation across the morpheme boundary. Included in the stimulus are re-suffixed items that respect sonorancy assimilation, as well as counterpart dissimilating items. A hypothesis for this part of the study, referred to as the r+l test, is given in (13).

(12) Experimental Hypothesis for the CC test

If the learners accept the CCC words as "good-sounding possible French words," then it can be concluded that they were transferring L1 English parameters onto the French test items. However, if they reject CCC forms like [palmlɛ̃g], while accepting CC counterparts like [palmɛ̃g], then the subjects would possess knowledge of French phonological patterning that extends well beyond what can be expected on the basis of L1 intuitions.

The second test investigates a possible learner and native tendency to prefer allomorphs that exhibit sonorancy agreement, such as [tiʁlɛ̃g] over non-agreeing counterparts, such as [*tiʁkɛ̃g]. While both forms represent well-formed, commonly occurring syllables in French, a preference for sonorancy agreement would indicate a strong influence of language universals in the judgment of new word items. A hypothesis for this study, hereafter referred to as the r+l test, is formulated in (13).

(13) Experimental hypothesis for the (r+l) test

If learners and natives accept or reject paired sonorancy allomorphs in an unsystematic way, then their judgments simply reflect a sensitivity to the relative frequencies of [rl] and [rk] syllables elsewhere in French. However, if subjects prefer [rl] items over [rk] items, then they are sensitive to universals of phonological grammar *in spite of* the relative frequencies of these syllable types in the input.

3.2. Subjects

For this experiment, 20 beginning, 30 intermediate, and 20 advanced learners of French were tested, all of whom were native speakers of English. The profile of the learner participants in the study is as homogeneous as possible for each group given real world limitations. At the same time, an effort was made to ensure the proficiency and experience level of each group was as distinct as possible. The beginner learners all had very little exposure to French with no experience abroad. The intermediate learners had a typical 3rd year level of proficiency with limited time abroad. The advanced learners had enough experience to be called "near-native" in French.

The beginners were all college students at Duke University in their sixth week of a first-semester French course. The intermediate learners were college students enrolled in 3rd-year French courses at either Indiana University or Duke University. The original number of intermediate subjects was 32. One subject was placed in the advanced speaker group because he indicated on his survey that he had family in France, where he had periodically resided, and that he had been misplaced in a 3rd-year French class. Another student clearly did not understand the task and gave responses that were more than two standard deviations from the means of his group. His data were not included in the analysis. The intermediate learners had a range of experience in a francophone country from no experience to a maximum of one summer (or 10 weeks). Among the advanced learners, there was a fairly broad range of time spent abroad, but the continuous duration of residence in a francophone country ranged from one to approximately three years.

Additionally, a control group of 20 native French speakers participated, as well as 15 English monolinguals in an analogous control task.

3.3. Task

The subjects were asked to judge multiple variants of 20 different test words for a total of 50 randomized test items. Three different randomized lists were used, meaning that subjects all responded to the same items in one of three orderings. A running story was provided in which a bilingual student living in France attempts to use *-ingue* suffixation with his friends to sound slangy or cool. For each item, a one-sentence context as well as the original French word that the re-suffixed word is based on were provided on the subjects' response sheets. For each item, the subjects heard a recorded sentence in French, all uttered by the same native French speaker, containing the test word. In order to avoid rejection of items based on invented spelling, the newly-invented word never appeared in writing.

Subjects were asked to agree or disagree with the statement "His new word sounds fine to me" and a five-point Likert scale was provided with the labels *disagree, somewhat disagree, unsure, somewhat agree*, or *agree*. A numerical value was assigned to each choice (-2/-1/0/1/2).

An example of the task is given in (14) for paired variants based on the French word *corbeille* (garbage receptacle) and *cours* (course or class):

(14) A sample task illustrating allomorphs of *corbeille* (garbage receptacle) and *cours* (a class):

a. Item #20. [subjects read] When Gregory's friends nearly knocked over the garbage can (*corbeille*), he shouted:

[subjects see and hear] ***Attention la*** _____ [corbingue] _____***!***

His new word sounds fine to me.

disagree   somewhat disagree   unsure   somewhat agree   agree

b. Item #36. [subjects read] When Gregory's friends nearly knocked over the garbage can (*corbeille*), he shouted:

[subjects see and hear] ***Attention la*** _____ [corbzingue] _____***!***

His new word sounds fine to me.

disagree   somewhat disagree   unsure   somewhat agree   agree

c.   Item #18. [subjects read] Gregory's friend had signed up for an interesting new class (*cours*). He was curious about it so he asked:

[subjects see and hear] ***C'est quoi comme*** _____ [courlingue] _____***!***

His new word sounds fine to me.

disagree   somewhat disagree   unsure   somewhat agree   agree

d.   Item #3. [subjects read] Gregory's friend had signed up for an interesting new class   (*cours*). He was curious about it so he asked:

[subjects see and hear] ***C'est quoi comme*** _____ [courkingue] _____***!***

His new word sounds fine to me.

disagree   somewhat disagree   unsure   somewhat agree   agree

As a control test, English monolinguals were presented with 30 recorded items that were structurally identical to the French CC items, but pronounced in English. Subjects were asked to rate the acceptance of these items for English only.

4. Results

For the consonant cluster test, a total of nine items containing a CCC sequence were analyzed and nine counterpart items containing CC sequences were analyzed. It was predicted that CC words would be "better sounding" than counterpart CCC words. In the r+l test a total of six r+l and six r+k items were analyzed. It was predicted that r+l allomorphs such as in *courlingue* would be "better sounding" than r+k allomorphs such as in *courkingue*.

4.1. Results for the CC test

For each subject, first a mean response for the CC items as well as the CCC items was calculated. Then an overall mean CC versus CCC response was calculated. For each group, the two overall means were compared in a paired-item, two-tailed *t*-test.[3] As per methodological convention, any token with a response of "unsure" was discarded from numerical analysis. The beginner group had a fairly high rate of "unsure" responses (between 20 to 40 percent of responses per survey). The aggregate means may point to an equal preference for CC or CCC items among the beginners, but responses were erratic and the *t*-test yielded no significant results. Due to the very limited exposure this group had to French, it was hoped that these results would serve as another sort of control group. It is true that in aggregate terms, the beginners appear to approve of CC and CCC items in similar proportions. But given the variability across test items and within each survey, the results cannot be strictly interpreted in this way. Many beginning subjects later told me that, contra the strong preferences reported by the other groups, they were often "just guessing." One participant later said that he was trying to put on his "French cap," (i.e., think in terms of what sounds French) but that he felt little confidence about many of the test items.

Aside from the beginners, there were relatively few "unsure" responses in the test.[4] Given that the response tendencies were robust and polarized, removing those tokens had no significant impact on the statistical results. Table 2 shows the overall mean CC and CCC values for each group. On average, English monolinguals assigned a positive (favorable) judgment to both CC (i.e., *dalming*) and CCC items (i.e., *dalmling*). They tended to accept CC and CCC items in similar proportions, indicating that the extra consonant posed no significant variable for this task. In contrast, while native French speakers also judged CC items favorably, they tended to assign a negative (disfavorable) judgment to CCC items, and a *t*-test confirms that the difference between the means was significant. This confirms that the task reflects the parametric difference exists between French and English regarding maximal syllable allowances. Beginning learners behaved similarly to the English monolinguals in that they also judged both CC and CCC items favorably. However, the intermediate and advanced learners showed a dramatic shift in behavior in that they tended to assign a negative value to the CCC items and a positive judgment to the CC items. A *t*-test confirms that the difference between the means of the two categories is significant in each of these groups. The bar graph in Figure 1 illustrates the contrast between the average CC response and its CCC counterpart.

Table 2. *Average Overall CC and CCC Responses Values by Group*

Group	Mean CC	Mean CCC	Statistics
Native Speakers ($n = 15$)	1.15	-0.66	$t(14)\ p < .01$
Advanced Learners ($n = 20$)	1.03	-1.18	$t(19)\ p < .01$
Intermediate Learners ($n = 30$)	0.93	-0.78	$t(29)\ p < .01$
Beginning Learners ($n = 20$)	0.96	0.77	$t(19)\ p = .10$
English Monolinguals ($n = 15$)	1.10	0.89	$t(14)\ p = .40$

Since CC items are grammatically licenced in both French and English, it is not surprising that all subject groups tend to judge them favorably and in similar proportions. The measure of whether learners have acquired native-like judgments of the French items lies in the rate of rejection of CCC items in each group. An ANOVA recognizing "group" as the independent 5-level factor on the amount of rejection of CCC items showed a significant difference due to proficiency level across groups, $F(4, 96) = 134.031$, $p = .001$). Post-hoc independent means tests showed a significant difference between all group pairs ($p = .05$). While intermediate and advanced learners judged CCC items far less favorably than CC items, it was not in perfectly native-like proportions. In fact, intermediate and advanced learners appear to reject CCC items in French even more strongly than the native French speakers themselves, a finding that was surprising, given the prevalence of CCC in English and the beginning learner results. In terms of judging the French re-suffixation items, not only do intermediate and advanced learners judge CCC items disfavorably, they appear to express stronger judgments of what is phonotactically illicit than the native speakers themselves. Figure 1 illustrates the CCC rejection rates for all of the groups and how intermediate and advanced learner performance overshot native levels.

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[4] As one anonymous reviewer noted, there are numerous advantages to including a separate confidence rating in the task. Due to the pilot nature of this study, a single-scale methodology was used for simplicity of data analysis. As is always the case when a single scale is used in psycholinguistic studies, this can complicate the interpretation of the results because both the binary (acceptance/non-acceptance) dimension and the gradient (confidence) dimension are forced into a single scale. An expanded version of this experiment is presented in Halicki (2009), which addresses these concerns and employs a separate confidence measure.
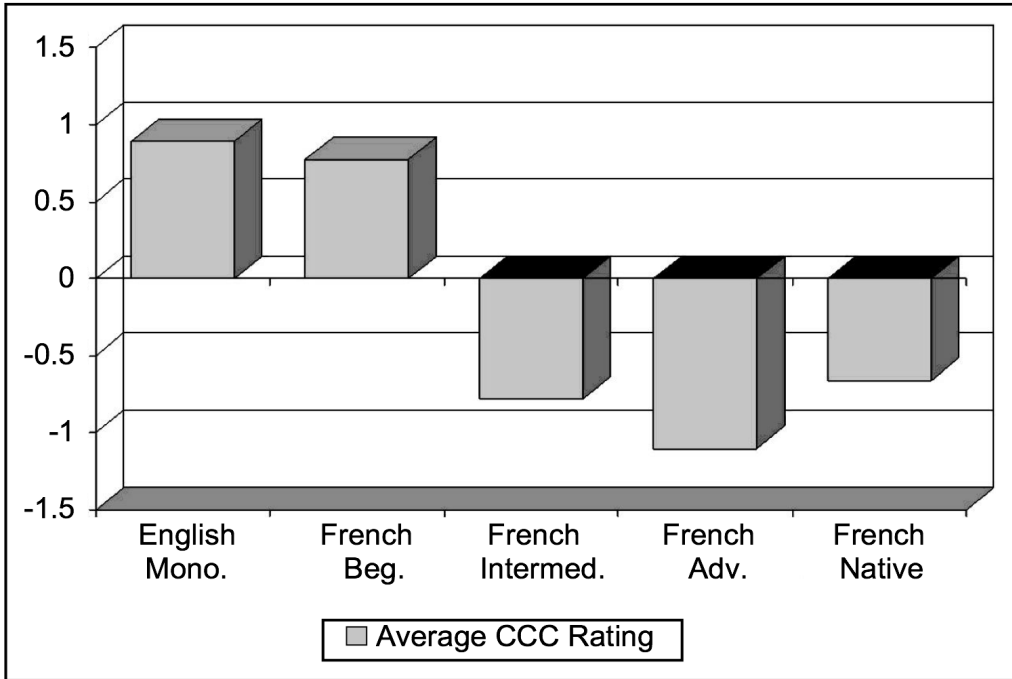
Figure 1. Bar graph indicating mean responses for CCC items for each group.

4.2. Results for the r+l test

Data analysis for the r+l test proceeded in the same way for each group as for the CC test using the statistical program OpenStat®. Mean r+l and r+k values were calculated for each subject, and overall means were compared in a *t*-test. Once again, responses of "unsure" were excluded from the calculation of the means. The results of the test are given in Table 3. The results of this test were similar to that of the CC test, but more pronounced. The beginners had positive mean scores for both categories, and their results failed to achieve significance.

Table 3. *Average r+l and r+k Response Values by Group*

Group	Mean r+l	Mean r+k	Statistics
Native Speakers ($n = 15$)	1.57	-1.44	$t(14)\ p = .00$
Advanced Learners ($n = 20$)	1.36	-1.43	$t(19)\ p = .00$
Intermediate Learners ($n = 30$)	1.42	-1.19	$t(29)\ p = .00$
Beginning Learners ($n = 20$)	1.2	0.42	$t(19)\ p = .08$

Compared to the CC test, the native speaker group shows the greatest difference, with a more marked preference for r+l items and dispreference for r+k items. The results in Table 3 are illustrated in Figure 2.
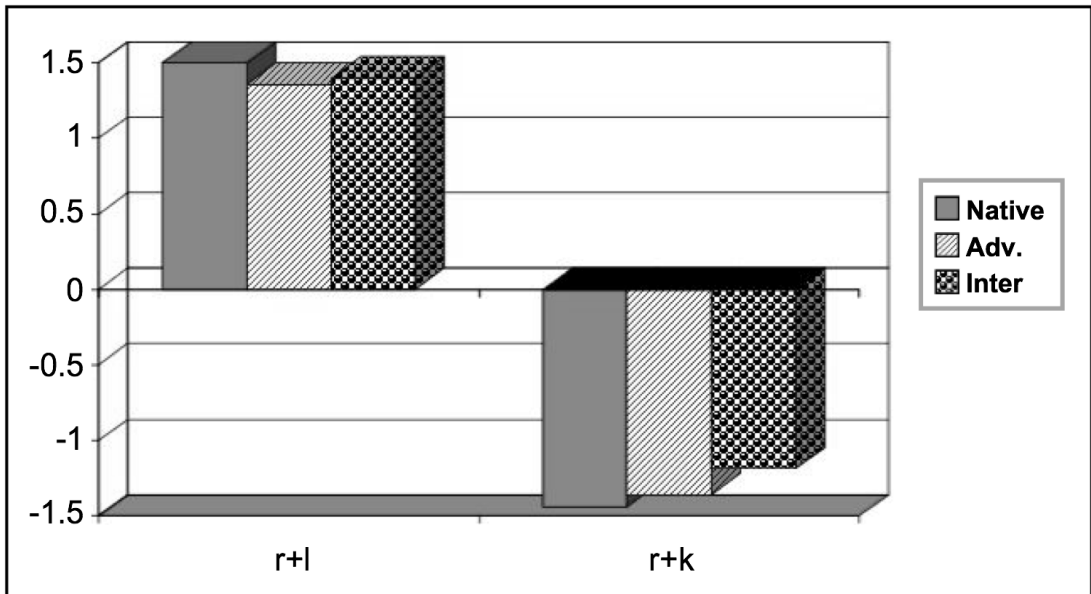
Figure 2. Bar graph indicating mean results for r+l items and r+k items.

Compared to the CC test, the mean responses were more polarized for the advanced and intermediate group as well, and there was less differentiation between the groups.

4.3. Discussion

The implications of the CC-test results are fairly straightforward. It is assumed in this analysis that, in English, items analogous to the CCC test items are well-formed and acceptable. The fact that the learners significantly reject forms like **corbzingue* indicates not only that they have native-like intuitions about the novel French items, but also that they are suppressing L1 English phonological parameters when judging the new words. Moreover, the results of the CC test reveal learner awareness of French syllable restrictions despite a more permissive L1 syllable structure. Given that the learners discerned this subtle property of L2 French phonology, in a systematic way, and in spite of variable data in the target language input, it is difficult to attribute this knowledge either to L1 knowledge or to explicit knowledge of French.

It may be tempting to interpret the results of the CC test in probabilistic terms. However, if it were simply the case that subjects preferred CC items because they occur more frequently, then we would expect this to be a general tendency across the proficiency groups. We would not expect the apparent progression that is observed between learners at the beginning versus intermediate level. The results of the r+l test also contradict a probabilistic account of acquisition. If subjects were simply responding to relative frequencies of [rl] and [rk] in the French lexicon, then the observed polarized acceptance of [rl] items and rejection of [rk] items would not be expected. A theory of acquisition that recognizes sensitivity to language universals is more plausible. Given that the sequence [rl] is less marked than [rk] in terms of sonority, it is logical that subjects judge items such as "courlingue" more favorably than words like "courkingue." The prediction at this point is that if an analogous task was constructed for English, subjects would respond in a similar way as for the French test.

5. Conclusion

The results of this study have shown that the use of a judgment task in conjunction with word transformations can be a powerful tool to probe L2 knowledge of target language phonotactics. The experiment tested learner and native performance in two areas of phonological acquisition that have received relatively little attention in generative L2 phonology: phonotactic constraints in perception

and morphological learning in derived environments. Analogous to previous findings in syntactic studies, the experimental results show that even intermediate learners are capable of judging the difference between novel French word items that are well-formed and those that are ill-formed. The fact that they are able to do this in spite of degenerate French input, L1 English effects, and in the absence of explicit teaching, raises the question of the source of the learner knowledge. Given the relative frequencies of CCC structures and [rk] sequences in the French lexicon, these findings do not support an account of L2 knowledge based on statistical learning. What is more plausible is that, like L2 syntax, L2 phonological grammar is constrained by domain-specific principles, or UG. If this is the case, it remains to be explained exactly *how* the learner, UG and language input interact in the development of L2 systems. Only a very small body of work has begun to address this question in the context of L2 phonology. In particular, Archibald (2004) and Dresher (1999) have proposed that UG associates parameters with specific cues in input. In this learning model, learners must "notice" the correct cue in the L2 in order to acquire a parameter in the presence of impoverished input. One possible cue triggering the acquisition of consonant cluster limits could be French liaison, a widespread phenomenon in which final consonants must re-syllabify into the onsets of following syllables. This would mean that familiarity with specific data, in this case, that word-final consonants in French are structurally licenced outside of their lexical unit, is implicated in the acquisition of a parameter, that is, that codas can have a maximum of one consonant. Identifying the correct cue for any parameter is, of course, an empirical question, to be determined by future study.

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Selected Proceedings of the 2008 Second Language Research Forum: Exploring SLA Perspectives, Positions, and Practices

edited by Matthew T. Prior,
Yukiko Watanabe, and Sang-Ki Lee

Cascadilla Proceedings Project   Somerville, MA   2010

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